Session 206

FireWire In Depth

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What You'll Learn

- How to start writing FireWire/Mac OS X device drivers
- How driver matching and loading works
- Where to find the SDK
  - http://developer.apple.com/hardware/FireWire/Developer_Info.html
- Source
  - http://www.apple.com/darwin

FireWire API in Mac OS X

- Asynchronous and Isochronous services, same as Mac OS 9
  - Same model—command based, but adapted to fit within IOKit
- Isochronous transport uses same powerful DCL mechanism as Mac OS 9—DCLs can be directly ported with little or no change

FireWire API in Mac OS X (Cont.)

- Rich SBP-2 service layer copied from Mac OS 9; supports
  - Unlimited LUNs (Logical Units) and ORBs (Operation Request Blocks); handles all VM and page table issues
  - Not limited to SCSI or storage; suitable for printers, scanners, and still cameras
- FireWire User Client provides full access to FireWire from user space
  - SBP-2 User Client provides full access to SBP-2 from user space

FireWire API in Mac OS X (Cont.)

- Can mix-and-match FireWire + SBP-2 user clients
- Extensive sample code for FireWire user client, SBP-2 user client, and DV capture/export tools
- SDK with step-by-step instructions for developers new to Mac OS X

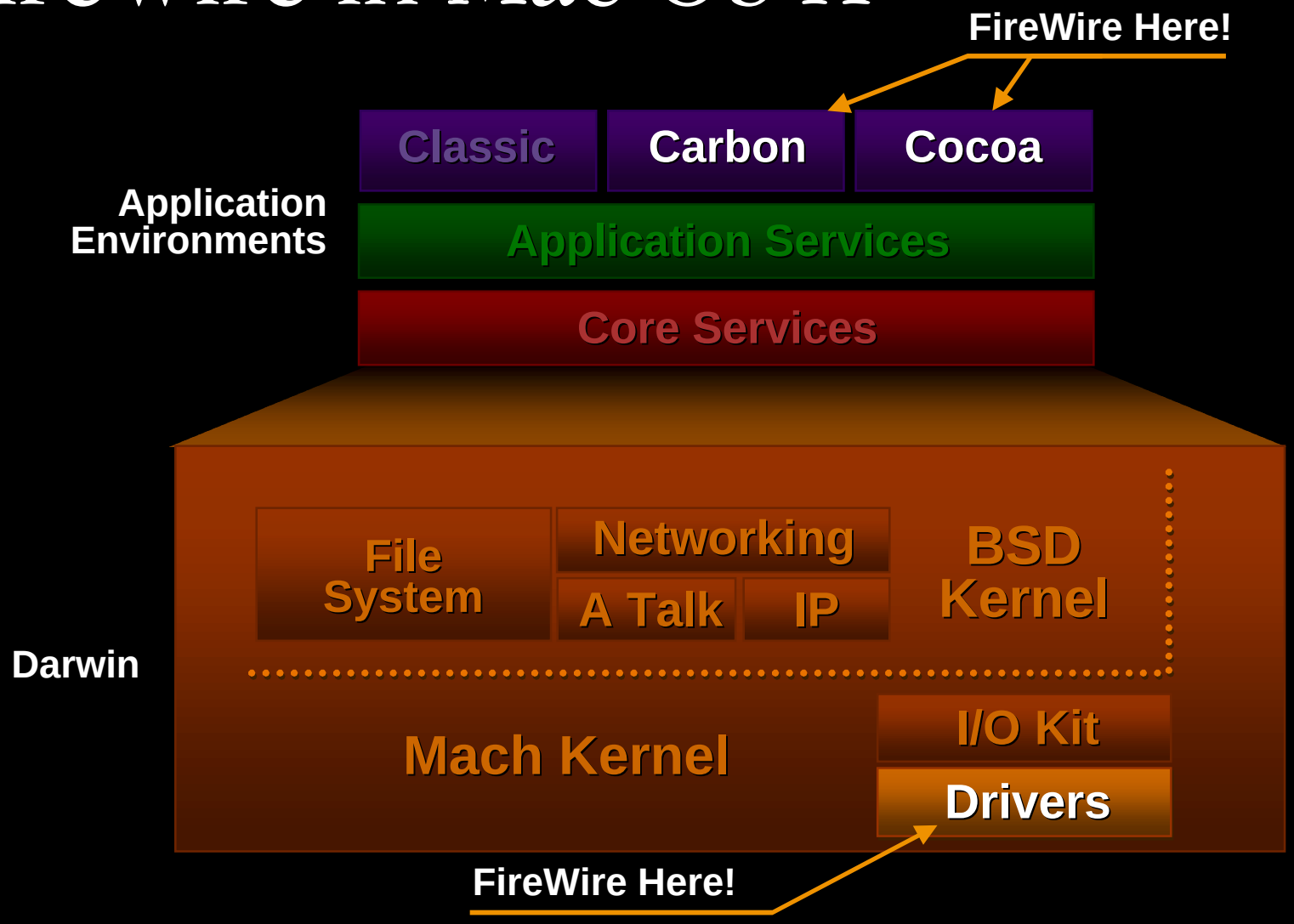
Core FireWire Services

- FireWire I/O Kit Family design is based on Mac OS 9 FireWire
- Implemented as set of kernel extensions
- IOFireWireFamily.kext—FireWire services
- AppleLynx.kext—Driver for PCI-Lynx
- AppleFWOHCI.kext—Driver for 1394 OpenHCI

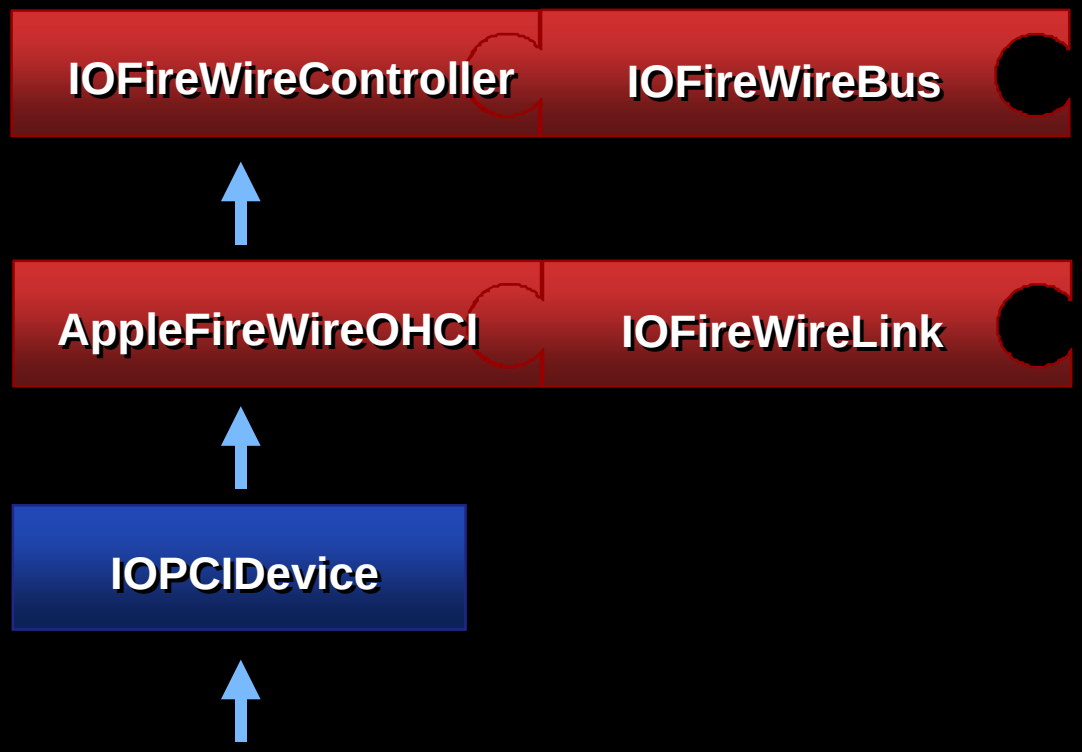
Additional FireWire Services

- IOFireWireDV.kext
- IOFireWireSBP2.kext
- Device Interfaces (“User Clients”)

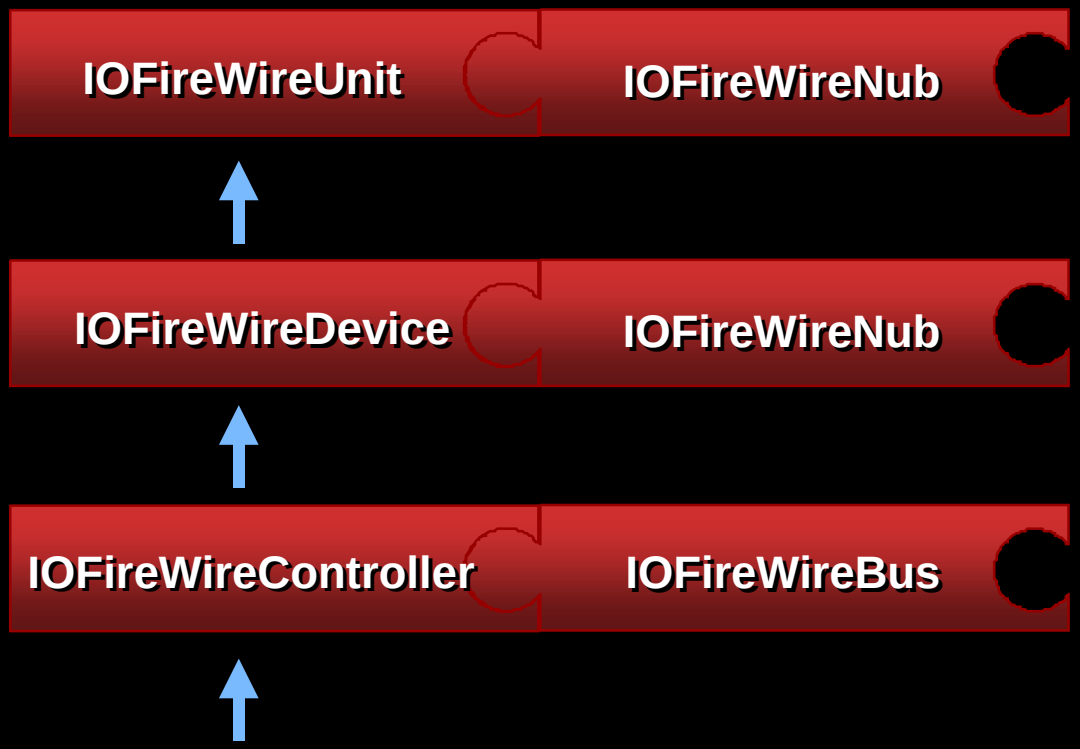
FireWire in Mac OS X



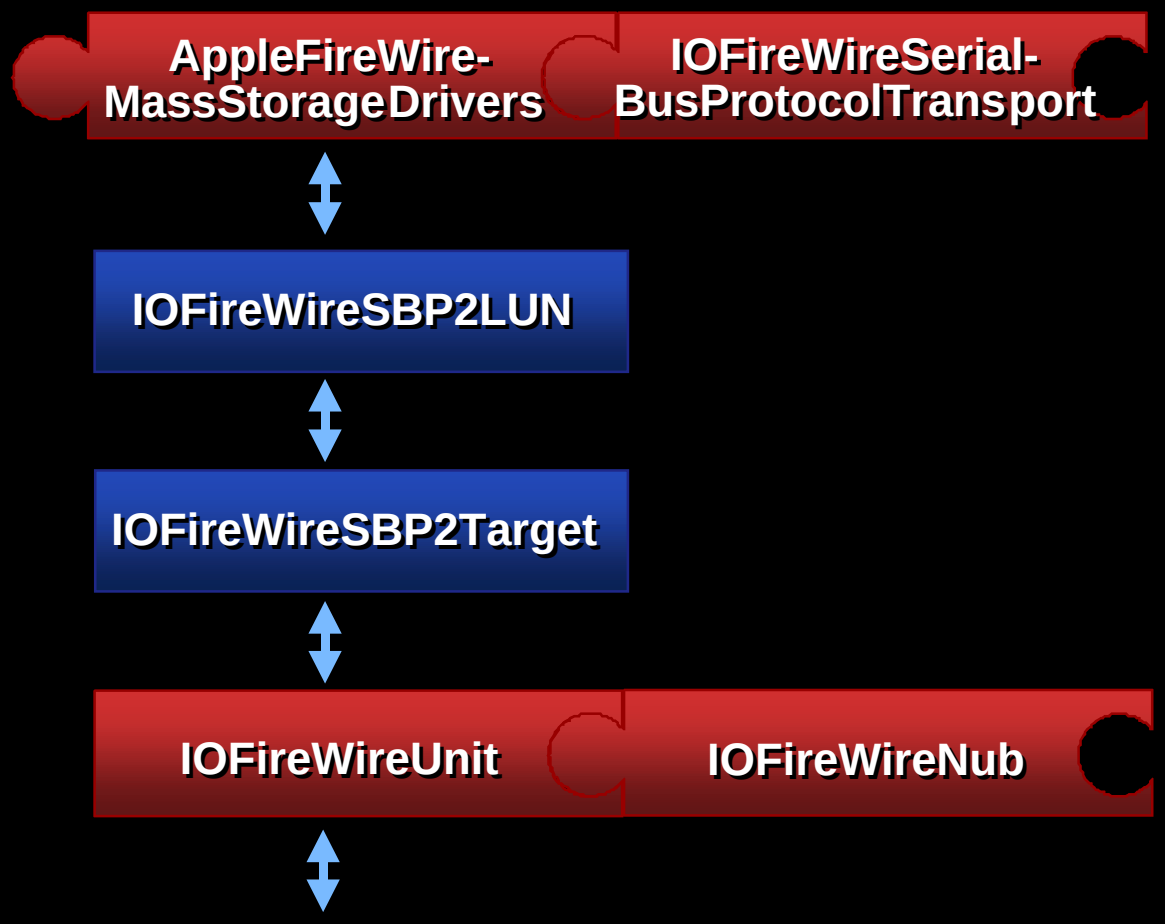
FireWire Stack Loading



FireWire Stack Loading (Cont.)

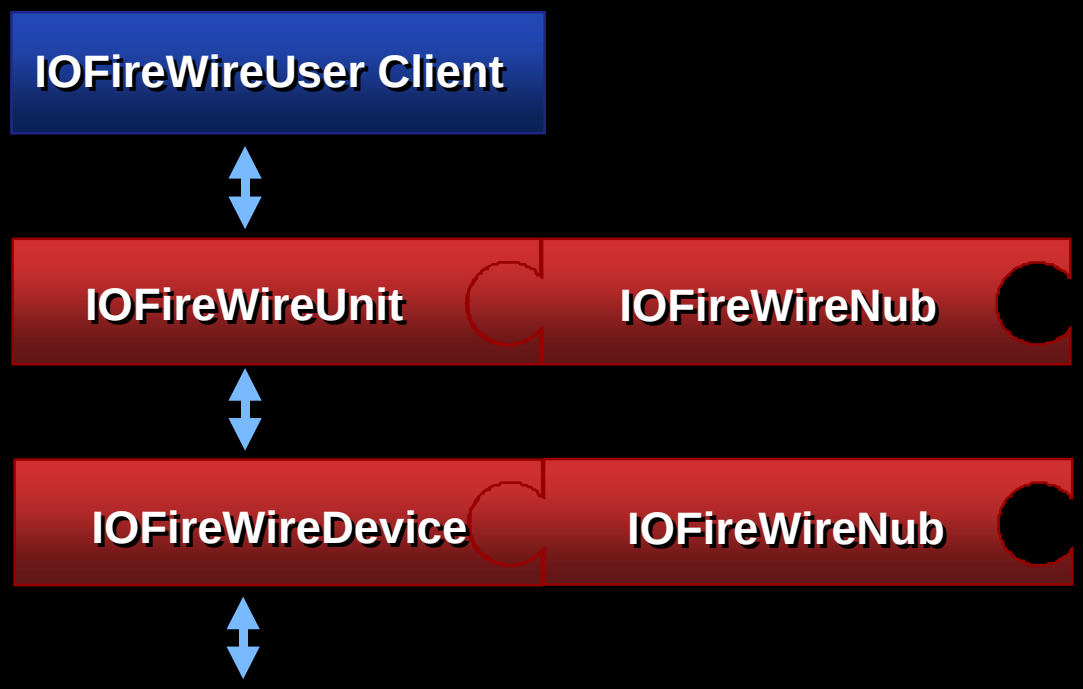


FireWire Stack Loading (Cont.)

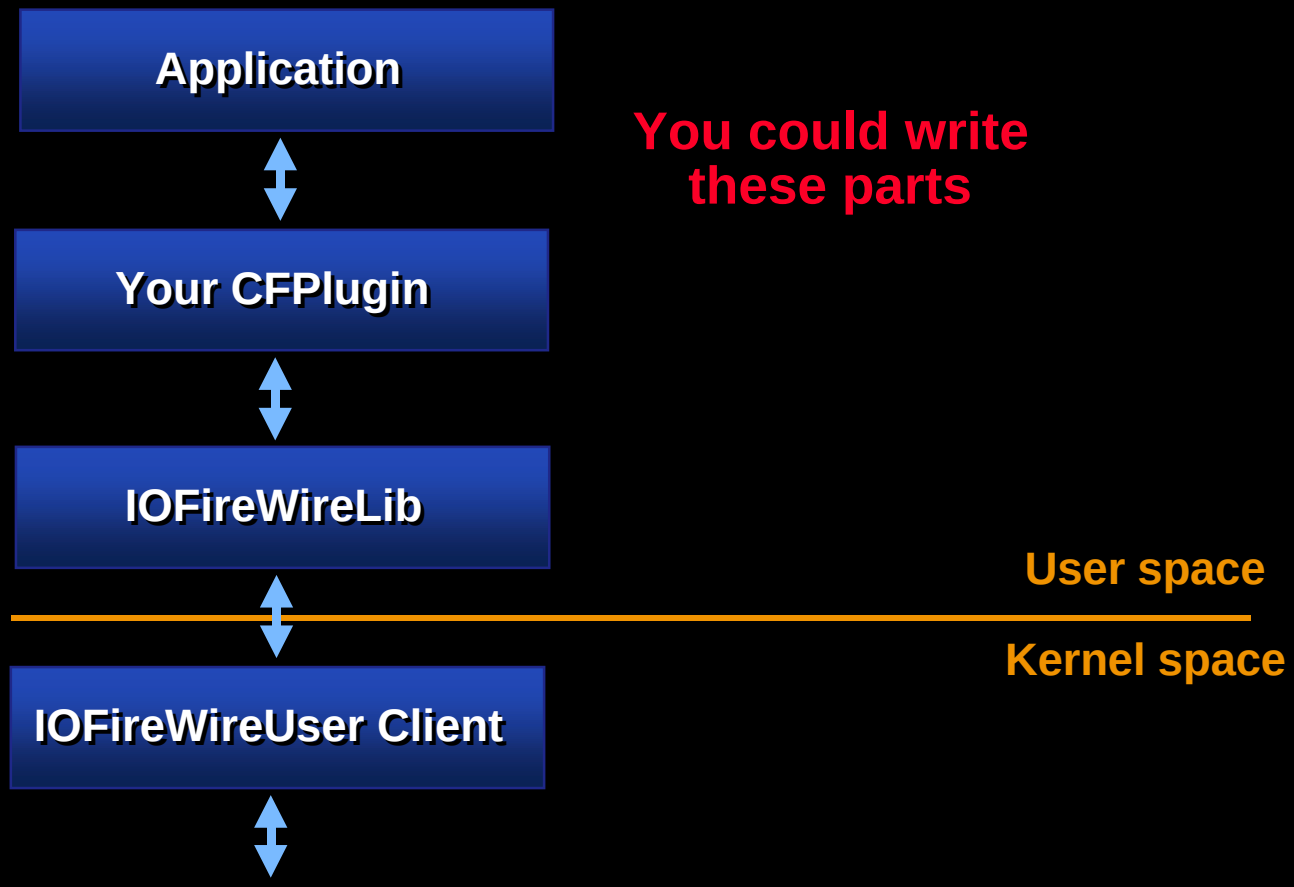


You could subclass this part

FireWire Stack Loading (Cont.)



FireWire Stack Loading (Cont.)



IOFireWireController

- Heart of FireWire Family
- Bus management
- Address space management
- Packet transmit/receive
- Provider for Protocol drivers
- AppleLynx, AppleFWOHCI access the hardware

IOFireWireDevice

- One per device on the bus
- Maintains node ID
- Match on Vendor_ID
- Main job is to publish IOFireWireUnits

IOFireWireUnit

- One per Unit Directory in device ROM
- Match on Unit_Spec_ID, Unit_SW_Version, Vendor_ID
- The Provider for most drivers
- IOFireWireDevice and IOFireWireUnit derive from IOFireWireNub

I/O Kit Registry Entries

- I/O Kit Service plane—matching
  - IOFireWireController
  - IOFireWireDevice
  - IOFireWireUnit
- IOFireWire Plane—Bus topology
  - IOFireWireController
  - IOFireWireDevice

Demo

IOFWCommand

- Command object
- Handles thread block/scheduling/callback logic
- Lots of derived classes
- IOFWAsyncCommand—send async requests
- IOFWBusCommand—e.g., allocate local addresses

IOFWIsochChannel

- One per allocated Isochronous channel
- Maintains channel allocation over bus resets

IOFWIsochPort

- Abstract object representing transmitter and receivers
- IOFWIsochChannel calls methods to start/stop etc.
- Provide a subclass to control your device

IOFWLocalIsochPort

- Implementation of IOFWIsochPort
- Mac's port
- Runs DCL program (same opcodes as Mac OS 9)

Device Interface (“User Client”)

- Enables access to FireWire from applications
- Use “stub” KEXT for IOKit matching
- Full access to kernel FireWire functions
- Isochronous services available soon

IOFireWireSBP2

- SBP-2 service layer derived from Mac OS 9
- Populates IO Registry with SBP matching data
- Used by Apple FireWire Disk Driver
  - IOFireWireSerialBusProtocolTransport.kext
  - AppleFireWireMassStorageDrivers.kext

SBP-2 Device Interface

- Provides SBP-2 kernel services to applications
- Use alone, or with plain FW Device Interface
- Designed for printers, scanners, cameras, etc.

IOFireWireDV

- Device driver for DV cameras
  - Normal and SDL video, capture and export
  - NTSC and PAL, including Device Control
- May move out of kernel in future
- Access through QuickTime (Sequence Grabber)

Summary of New Features

- Full support for Open HCI
- SBP-2 service layer, and Apple disk driver
- User Client, and SBP-2 User Client
- DV driver and QuickTime component
- FireWire Booting
- SDKs (free download)

Work in Progress

- Isochronous services in Device Interface
  - With sample “DCAM” device driver
- More sample code, documentation, and tools
- IEEE 1394.3 (“PPDT”) support
- IEEE 1212r Instance Directory support
- IEEE P1394b support

Wrap-Up

- Extensive FireWire services in Mac OS X today
- Use the SDK and firewire@isg.apple.com list
  - http://developer.apple.com/hardware/FireWire/Developer_Info.html
  - No confidential information on the mailing list!
- Submit bug fixes for Open Source code

Related Sessions

204 I/O Kit: Storage Drivers:
Mass storage in Mac OS X

Room A2
Tues., 5:00pm

FF108 Feedback Forum:
FireWire & USB:
Tell us what you think

Room J1
Thurs., 2:00pm

FireWire Plugfest:
Plug in devices, lots of beer

Apple Campus
Thurs., 6:00pm

Q&A

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http://developer.apple.com/events/urls.html

WWDC

Worldwide Developers Conference 2001